

William E. Rich, et al.
Application No.: 09/560,715
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

William E. Rich, et al. ✓

Application No.: 09/560,715 ✓

Filed: April 27, 2000 ✓

For: ✓ PROBES FOR A GAS PHASE ION
SPECTROMETER

Examiner: Ahmed, Sheeba ✓

Art Unit: 1773 ✓

RESPONSE TO RESTRICTION
REQUIREMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

In response to the Election of Species Requirement mailed October 22, 2002, Applicants submit their election of species for claims 17 and 18.

REMARKS

The Election of Species Requirement

The Examiner has required a further election of species for claims 17 and 18. The Examiner states that claim 17 recites 10 distinct species, and that claim 18 recites 13 distinct species.

In response to the Requirement, Applicants elect species (3) "electrostatic interactions" for claim 17, and species (4) "ammonium group" for claim 18. Pending claims 1-4, 6-11, 13-36 and 76-93 read on the species elected.

Applicants respectfully traverse the Election of Species requirement on the basis that each of the species recited in claims 17 and 18 emerge from a common inventive concept. Thus, no undue burden would be placed on the Examiner by searching the species together.

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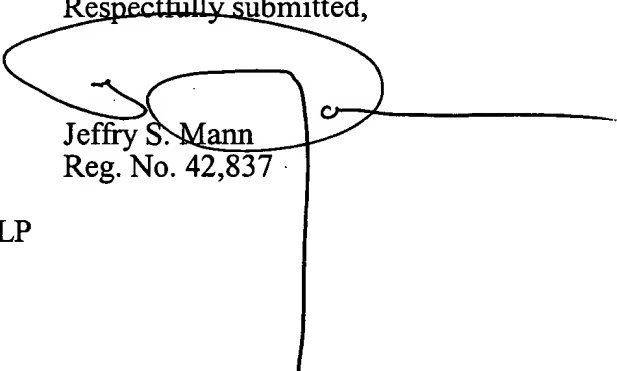
PATENT

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 415-576-0200.

Respectfully submitted,



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CLAIMS PENDING AFTER AMENDMENT

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1 1. (Once amended) A probe that is removably insertable into a mass
2 spectrometer, the probe comprising a substrate having a surface coated with silicon oxide
3 and a hydrogel material on the surface, wherein the hydrogel material is crosslinked and
4 comprises binding functionalities for binding with an analyte detectable by the mass
5 spectrometer.

1 2. (As filed) The probe of claim 1 wherein the substrate is in the
2 form of a strip or a plate.

1 3. (Once amended) The probe of claim 1 wherein the substrate
2 comprises an electrically conducting material.

1 4. (As filed) The probe of claim 1 wherein the surface of the
2 substrate is conditioned to adhere the hydrogel material.

1 6. (As filed) The probe of claim 1 wherein the surface of the
2 substrate is rough, porous or microporous.

1 7. (As filed) The probe of claim 1 wherein the hydrogel material is in
2 situ polymerized on the surface of the substrate.

1 8. (Once amended) The probe of claim 1 wherein the hydrogel
2 material is in situ polymerized on the silicon oxide coating by depositing a solution
3 comprising monomers onto the glass coating, wherein the monomers are pre-
4 functionalized to provide binding functionalities.

1 9. (Once amended) The probe of claim 1 wherein the thickness of the
2 coating and the hydrogel material combined is at least about 1 micrometer.

1 10. (As filed) The probe of claim 1 wherein the hydrogel material is at
2 least about 1 micrometer thick.

1 **11.** (As filed) The probe of claim 1 wherein the hydrogel material is in
2 the form of a discontinuous pattern.

1 **13.** (As filed) The probe of claim 1 wherein the hydrogel material is
2 continuous and has one or two-dimensional gradient of one or more of the binding
3 functionalities.

1 **14.** (As filed) The probe of claim 1 wherein a plurality of different
2 hydrogel materials comprising different binding functionalities are on the surface of the
3 substrate.

1 **15.** (As filed) The probe of claim 1 wherein the hydrogel material is a
2 homopolymer, a copolymer, or a blended polymer.

1 **16.** (As filed) The probe of claim 1 wherein the hydrogel material is
2 derived from substituted acrylamide monomers, substituted acrylate monomers, or
3 derivatives thereof.

1 **17.** (As filed) The probe of claim 1 wherein the binding functionalities
2 attract the analyte by salt-promoted interactions, hydrophilic interactions, eletrostatic
3 interactions, coordinate interactions, covalent interactions, enzyme site interactions,
4 reversible covalent interactions, nonreversible covalent interactions, glycoprotein
5 interactions, biospecific interactions, or combinations thereof.

1 **18.** (As filed) The probe of claim 1 wherein the binding functionalities
2 of the hydrogel material are selected from the group consisting of a carboxyl group, a
3 sulfonate group, a phosphate group, an ammonium group, a hydrophilic group, a
4 hydrophobic group, a reactive group, a metal chelating group, a thioether group, a biotin
5 group, a boronate group, a dye group, a cholesterol group, and derivatives thereof.

1 **19.** (Once amended) The probe of claim 18 wherein the binding
2 functionalities comprise a carboxyl group and the hydrogel material is derived from
3 monomers selected from the group consisting of (meth)acrylic acid, 2-carboxyethyl
4 acrylate, N-acryloyl-aminohexanoic acid, N-carboxymethylacrylamide, 2-
5 acrylamidoglycolic acid, and derivatives thereof.

1 **20.** (Once amended) The probe of claim 18 wherein the binding
2 functionalities comprise a sulfonate group and the hydrogel material is derived from
3 acrylamidomethyl-propane sulfonic acid monomers or derivatives thereof.

1 **21.** (Once amended) The probe of claim 18 wherein the binding
2 functionalities comprise a phosphate group and the hydrogel material is derived from N-
3 phosphoethyl acrylamide monomers or derivatives thereof.

1 **22.** (Once amended) The probe of claim 18 wherein the binding
2 functionalities comprise an ammonium group and the hydrogel material is derived from
3 monomers selected from the group consisting of trimethylaminoethyl methacrylate,
4 diethylaminoethyl methacrylate, diethylaminoethyl acrylamide, diethylaminoethyl
5 methacrylamide, diethylaminopropyl methacrylamide, aminopropyl acrylamide, 3-
6 (methacryloylamino)propyltrimethylammonium chloride, 2-aminoethyl methacrylate,
7 N-(3-aminopropyl)methacrylamide, 2-(t-butylamino)ethyl methacrylate, 2-(N, N-
8 dimethylamino)ethyl (meth)acrylate, N-(2-(N, N-dimethylamino))ethyl
9 (meth)acrylamide, N-(3-(N, N-dimethylamino))propyl methacrylamide, 2-
10 (meth)acryloyloxyethyltrimethylammonium chloride, 3-methacryloyloxy-2-
11 hydroxypropyltrimethylammonium chloride, (2-acryloyloxyethyl)(4-
12 benzoylbenzyl)dimethylammonium bromide, 2-vinylpyridine, 4-vinylpyridine,
13 vinylimidazole, and derivatives thereof.

1 **23.** (Once amended) The probe of claim 18 wherein the binding
2 functionalities comprise a hydrophilic group and the hydrogel material is derived from

3 monomers selected from the group consisting of N-
4 (meth)acryloyltris(hydroxymethyl)methylamine, hydroxyethyl acrylamide,
5 hydroxypropyl methacrylamide, N-acrylamido-1-deoxysorbitol,
6 hydroxyethyl(meth)acrylate, hydroxypropylacrylate, hydroxyphenylmethacrylate,
7 polyethylene glycol monomethacrylate, polyethylene glycol dimethacrylate, acrylamide,
8 glycerol mono(meth)acrylate, 2-hydroxypropyl acrylate, 4-hydroxybutyl methacrylate, 2-
9 methacryloxyethyl glucoside, poly(ethyleneglycol) monomethyl ether monomethacrylate,
10 vinyl 4-hydroxybutyl ether, and derivatives thereof.

1 **24.** (Once amended) The probe of claim 18 wherein the binding
2 functionalities comprise a hydrophobic group and the hydrogel material is derived from
3 monomers selected from the group consisting of N, N-dimethyl acrylamide, N, N-diethyl
4 (meth)acrylamide, N-methyl methacrylamide, N-ethyl methacrylamide, N-propyl
5 acrylamide, N-butyl acrylamide, N-octyl (meth)acrylamide, N-dodecyl methacrylamide,
6 N-octadecyl acrylamide, propyl (meth)acrylate, decyl (meth)acrylate, stearyl
7 (meth)acrylate, octyl-triphenylmethylacrylamide, butyl-triphenylmethylacrylamide,
8 octadecyl-triphenylmethylacrylamide, phenyl-triphenylmethylacrylamide, benzyl-
9 triphenylmethylacrylamide, and derivatives thereof.

1 **25.** (Once amended) The probe of claim 18 wherein the binding
2 functionalities comprise a metal chelating group and the hydrogel material is derived
3 from monomers selected from the group consisting of N-(3-N, N-
4 biscarboxymethylamino)propyl methacrylamide, 5-methacrylamido-2-(N, N-
5 biscarboxymethylamino)pentanoic acid, N-(acrylamidoethyl)ethylenediamine N, N', N'-
6 triacetic acid, and derivatives thereof.

1 **26.** (Once amended) The probe of claim 18 wherein the binding
2 functionalities comprise a reactive group and the hydrogel material is derived from
3 monomers selected from the group consisting of glycidyl acrylate, acryloyl chloride,
4 glycidyl(meth)acrylate, (meth)acryloyl chloride, N-acryloxysuccinimide, vinyl azlactone,

5 acrylamidopropyl pyridyl disulfide, N-(acrylamidopropyl)maleimide, acrylamidodeoxy
6 sorbitol activated with bis-epoxirane compounds, allylchloroformate, (meth)acrylic
7 anhydride, acrolein, allylsuccinic anhydride, citraconic anhydride, allyl glycidyl ether,
8 and derivatives thereof.

1 **27.** (Once amended) The probe of claim 18 wherein the binding
2 functionalities comprise a thioether group and the hydrogel material is derived from
3 thiophilic monomers selected from the group consisting of 2-hydroxy-3-
4 mercaptopyridylpropyl (methacrylate), 2-(2-(3-
5 (meth)acryloxyethoxy)ethanesulfonyl)ethylsulfanyl ethanol, and derivatives thereof.

1 **28.** (Once amended) The probe of claim 18 wherein the binding
2 functionalities comprise a biotin group and the hydrogel material is derived from biotin
3 monomers selected from the group consisting of N-biotinyl-3-
4 (meth)acrylamidopropylamine and derivatives thereof.

1 **29.** (Once amended) The probe of claim 18 wherein the binding
2 functionalities comprise a boronate group and the hydrogel material is derived from
3 boronate monomers selected from the group consisting of N-(m-dihydroxyboryl)phenyl
4 (meth)acrylamide and derivatives thereof.

1 **30.** (Once amended) The probe of claim 18 wherein the binding
2 functionalities comprise a dye group and the hydrogel material is derived from dye
3 monomers selected from the group consisting of N-(N'-dye coupled aminopropyl)
4 (meth)acrylamide and derivatives thereof.

1 **31.** (Once amended) The probe of claim 18 wherein the binding
2 functionalities comprise a cholesterol group and the hydrogel material is derived from
3 cholesterol monomers selected from the group consisting of N-cholesteryl-3-
4 (meth)acrylamidopropylamine and derivatives thereof.

1 32. (Once amended) A probe that is removably insertable into a mass
2 spectrometer, the probe comprising a substrate having a surface and a plurality of
3 particles that are substantially uniform in diameter on the surface, the particles
4 comprising binding functionalities for binding with an analyte detectable by the mass
5 spectrometer.

1 33. (As filed) The probe of claim 32 wherein the plurality of particles
2 have an average diameter of less than about 1000 μm .

1 34. (As filed) The probe of claim 32 wherein the particles have a
2 coefficient of diameter variation of less than about 5%.

1 35. (As filed) The probe of claim 32 wherein the surface of the
2 substrate is conditioned to adhere to the particles.

1 36. (As filed) The probe of claim 32 wherein the binding
2 functionalities of the particles are selected from the group consisting of a carboxyl group,
3 a sulfonate group, a phosphate group, an ammonium group, a hydrophilic group, a
4 hydrophobic group, a reactive group, a metal chelating group, a thioether group, a biotin
5 group, a boronate group, a dye group, a cholesterol group, and derivatives thereof.

1 76. (New) The probe of claim 1 wherein the binding functionality is a
2 reactive group selected from an epoxide and a carbonyldiimidazole.

1 77. (New) The probe of claim 1 wherein the hydrogel material is
2 derived from monomers selected from the group consisting of 3-
3 (methacryloylamino)propyltrimethylammonium chloride, 2-acrylamidoglycolic acid
4 and 5-methacrylamido-2-(N, N-biscarboxymethylamino)pentanoic acid.

1 78. (New) The probe of claim 1 wherein the hydrogel material
2 comprises cellulose or dextran.

- 1 **79.** (New) The probe of claim 1 wherein the surface is substantially
2 smooth.
- 1 **80.** (New) The probe of claim 1 wherein the hydrogel is about 1
2 micrometer thick.
- 1 **81.** (New) The probe of claim 1 wherein the substrate comprises an
2 insulating material.
- 1 **82.** (New) The probe of any of claims 1-4, 6-11, 13-31 or 76-81
2 wherein the surface of the substrate is conditioned with a coupling agent and the hydrogel
3 material adheres to the surface through a covalent interaction with the coupling agent.
- 1 **83.** (New) The probe of any of claims 1-4, 6-10, 14-31 or 76-81
2 wherein the hydrogel is attached to the surface in a plurality of discontinuous spots.
- 1 **84.** (New) The probe of claim 82 wherein the coupling agent is a
2 silane-based agent.
- 1 **85.** (New) The probe of claim 82 wherein the hydrogel is attached to
2 the surface in a plurality of discontinuous spots.
- 1 **86.** (New) The probe of claim 1 wherein the binding functionality is a
2 reactive group selected from an epoxide and a carbonyldiimidazole.
- 1 **87.** (New) The probe of claim 32, 36 or 86 wherein the particles are
2 comprised of crosslinked polymers.
- 1 **88.** (New) The probe of claim 87 wherein the crosslinked polymers
2 comprise polystyrenes.

1 **89.** (New) The probe of claim 87 wherein the crosslinked polymers
2 comprise polysaccharides, agarose, dextran, methacrylates or functionalized silicon
3 dioxide.

1 **90.** (New) The probe of claim 87 wherein the particles comprise a
2 latex.

1 **91.** (New) The probe of claim 90 wherein the plurality of particles
2 have an average diameter of between about 0.1 μm to about 100 μm .

1 **92.** (New) The probe of claim 90 wherein the plurality of particles
2 have an average diameter of between about 1 μm to about 10 μm .

1 **93.** (New) The probe of claim 1 wherein the hydrogel material is less
2 than about one micrometer thick.